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Progress in the implementation of the Programme of Action for the Sustainable Development of Small Island Developing States

Report of the Secretary-General

Addendum

Sustainable development of energy resources in small island developing States*

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I. Introduction

1. Despite the fact that an accelerated increase in the availability of energy services in small island developing States is critical to foster their economic growth and thus to improve the welfare of people, there has been little or no progress made in this regard in the majority of those countries. As a matter of fact, several of them have registered declines in per capita consumption of primary commercial energy during the period 1992–1995, the result of economic factors and slower rate of increase of energy supply compared with demand associated with expanding population.

2. However, efforts have continued, primarily through international assistance programmes, to develop and use renewable energy sources. Solar photovoltaic (PV) home systems for lighting, radio/television and telecommunication, particularly in remote locations, have increased in absolute terms.

3. Nevertheless, imported petroleum remains the chief source of commercial energy in small island developing States. A number of small island developing States continue to rely heavily on traditional forms of biomass energy, especially wood fuels for cooking and in a variety of small-scale agricultural processing. With regard to traditional biomass fuels, their sustainable levels and efficient use are matters of concern for all those countries with heavy dependence on such fuels.

II. Energy demand

4. Imported petroleum, mainly end-use products, remains the chief source of primary commercial energy, largely for transport and electricity generation. During the period 1992–1995, total petroleum consumption of small island developing States increased by an average annual rate of 3.7 per cent, to a total of about 58.5 million tons of oil in 1995. Their daily demand in 1995 was about 1.17 million barrels of oil, out of a total world consumption of more than 68.18 million barrels per day in 1995, or about 1.7 per cent of the world total. The total daily petroleum demand of small island developing States excluding island countries or areas with substantial oil and gas production and with major export-oriented oil refineries (Bahrain, Papua New Guinea, Trinidad and Tobago, the Netherlands Antilles, Singapore and the United States Virgin Islands) was even less significant. In 1995, it was about 407,000 barrels per day, or about 0.6 per cent of the total daily world oil demand.

5. While overall petroleum consumption of small island developing States increased, a number of them registered negative or no growth in their total oil consumption during 1992–1995. During this period, many small island developing States experienced declines in per capita consumption of commercial primary energy (see table 1).

6. Inasmuch as energy conservation and efficiency programmes can be of great benefit in managing demand, implementation of such measures in small island developing States has been sporadic and much remains to be done. On the supply side, given the predominance of petroleum products in the commercial energy mix, reduction of losses in storage and in transit would result in tangible gains. Efforts are also needed to improve the efficiency of electricity generation and distribution. On the demand side, the focus should be on improving the energy efficiency of electrical appliances and motor vehicles. Considerable benefits can be derived from simple conservation measures, such as proper operation and maintenance of equipment and replacement of inefficient appliances. To realize those goals, institutional capacity, policy and financing instruments, and manpower need to be strengthened.

7. As regards the ratio of petroleum imports to total merchandise exports including petroleum products, in most of the small island developing States it remains comparatively higher than in other developing countries and has remained practically unchanged since 1992. There have been some declines in the share of petroleum imports in total merchandise imports, although in a few countries the ratio has actually increased significantly (see table 2).

8. A majority of small island developing States continue to depend heavily on traditional forms of biomass energy, fuelwood, charcoal and bagasse, particularly in rural areas, accounting for more than 50 per cent of total energy demand in many of them. Almost all fuelwood for cooking, especially in rural households, are obtained at no financial cost from natural forests but at considerable social cost. Also widely used are coconut shells, husks and stemwood, and residues from such crops as coffee, cocoa, maize, cassava, peanuts and rice. The challenge is to use these efficiently. In small island developing States with large-scale sugar cane plantations, bagasse is used for fuel in sugar mills and for electricity generation. Introduction of bagasse cogeneration systems needs to be pursued.

III. Use of renewable energy sources

9. In absolute terms, the use of modern renewable energy technology has increased, particularly solar PV systems, enabling households in small remote villages to operate a few electric lights and small appliances, such as televisions and video cassette recorders, small medical refrigerators, telecommunication equipment and water pumps.

10. In a number of small island developing States, the use of small-scale solar PV power in rural electrification appears to have been successful. Those experiences suggest that solar PV can play a useful role in meeting the demand for electricity in isolated pockets of low-load densities. In such situations with small loads typical of rural households in remote areas, PV power would prove to be more economical compared with diesel-based systems. With the fast-declining capital costs of PV panels, solar PV systems are likely to be cheaper than diesel systems with their higher variable costs, given that diesel fuel is relatively more costly in small island developing States remote from main petroleum products supply points. The life cycle cost advantages of solar PV systems could even be greater where consumers are increasing steadily over time, as it would apparently be easier to install additional solar PV systems, which are largely modular, than to install diesel systems, which invariably have to be sized from the outset for anticipated load growth.

11. The attractiveness of solar PV home systems from the user's perspective is that the current capital costs of installing the systems, especially in rural electrification programmes, are heavily subsidized by government or donor agencies. In such cases, solar PV systems are very attractive to users because they do not have to bear the capital costs, and also because solar PV systems have very low operation and maintenance costs compared to diesel systems. Currently, very few if any renewable energy sources are being developed on a commercial basis in small island developing States, and if the increased use of solar PV systems continues to depend on public funding and external assistance, effective institutional approaches must be developed. A number of different institutional arrangements have been tried but most have failed, although the approach that involves a professional agency run on a commercial basis installing the system and providing maintenance on a fee-for-service basis appears to be relatively successful. The availability of financing and credit facilities can contribute significantly to the commercialization of renewable energy applications.

12. Technological constraints in the use of solar PV systems appear to have been overcome by the increased robustness of currently available household size systems, with proper installation and adequate maintenance. Nonetheless, technical viability must be complemented by effective institutional arrangements to ensure sustained success in the use of solar PV systems.

IV. Energy resources development: options and recommendations

13. Based on the experiences of the past 20 years, it is evident that while the energy strategies of the small island economies will continue to remain primarily focused on improving the management and regulation of petroleum fuels and electric power plants, increasing the role for renewable energy should become an important part of the overall strategy in many small island developing States. Since energy conservation and efficiency measures are the most effective ways to achieve significant savings in energy consumption, concerted efforts supported by external assistance are needed to promote and implement these measures.

14. The almost total dependence of small island developing States on imported petroleum for their commercial energy needs continues to cause severe imbalances in trade. Increased use of fuelwood has led to much deforestation. To arrest those adverse developments, small island developing States will need to increase their efforts in the development and use of indigenous renewable energy resources. In their efforts to harness renewable energy sources, small island developing States will need enhanced technical, managerial, financial and particularly external assistance to make the necessary investments.

15. The development of renewable energy sources will depend not only on the choice of appropriate technology but also on adequate development of managerial and technical expertise, careful financial management and adoption of appropriate institutional approaches. For small loads typical of rural households in remote areas with sufficient insolation, solar PV systems are proving to be economically and technically successful, when complemented by an institutional approach, including financial arrangements, that provides for the installation of the systems and maintenance on a fee-for-service basis.

16. Major technical advances in recent years have led to much improved cost-effectiveness of renewable energy technologies providing more opportunities for commercial use of those technologies. Adequate wind regimes exist in many small island developing States, although wind energy remains underutilized. Similarly, hydropower resources are being utilized where adequate sites and institutional support are available. Several small island developing States also have sustainable biomass cover for the development of modern biomass energy.

17. Assistance should continue to be provided, where appropriate, in the formulation of energy policies, technical standards and guidelines for the energy sector of small island developing States and to enhance national capacity to effectively plan and manage their energy systems.

Table 1
Total and per capita primary energy consumption, 1982–1995

Country or area	Total energy consumption (thousands of tons of oil equivalent)					Per capita consumption (kilograms of oil equivalent)				
	1982	1992	Annual change 1982–1992 (percentage)	1995	Annual change 1992–1995 (percentage)	1982	1992	Annual change 1982–1992 (percentage)	1995	Annual change 1992–1995 (percentage)
Atlantic										
Cape Verde	34	36	0.5	36	0.0	110	101	-0.8	98	-0.8
Sao Tome and Principe	12	25	6.7	26	1.0	135	202	3.7	195	-0.9
Indian Ocean and adjacent areas										
Comoros	12	22	5.5	23	1.1	29	39	2.7	38	-0.6
Maldives	6	50	19.4	62	5.5	37	217	16.2	244	3.0
Mauritius	170	448	8.8	505	2.7	171	421	8.2	452	1.8
Seychelles	28	50	5.3	54	1.4	406	718	5.2	740	0.8
Pacific										
Cook Islands	12	7	-4.9	7	0.0	632	368	-4.9	368	0.0
Fiji	256	253	-0.1	267	1.4	393	339	-1.3	341	0.1
Kiribati	9	7	-2.3	7	0.0	150	93	-4.3	90	-0.8
Marshall Islands	..	..	..	..	..	..	..	..	..	..
Micronesia (Federated States of)	..	..	..	..	..	..	..	..	..	..
Nauru	40	44	0.9	45	0.6	5 714	4 400	-2.4	4 091	-1.8
Niue	1	1	0.0	1	0.0	250	500	6.3	500	0.0
Northern Marianas	..	..	..	..	..	..	..	..	..	..
Palau	50	82	4.5	83	0.3	352	363	0.4	342	-1.8
Papua New Guinea	667	784	1.5	856	-0.3	195	216	0.9	199	-2.0
Samoa	39	45	1.3	46	0.6	244	278	1.2	279	0.1
Solomon Islands	41	53	2.3	53	0.0	165	155	-0.6	140	-2.5
Tokelau	..	..	..	..	..	..	..	..	..	..
Tonga	14	30	6.9	35	3.9	139	309	7.3	357	3.7
Tuvalu	..	..	..	..	..	..	..	..	..	..
Vanuatu	17	20	1.5	20	0.0	134	127	-0.5	118	-1.8
Caribbean										
Antigua and Barbuda	83	96	1.3	108	3.0	1 078	1 477	2.9	1 636	2.6
Aruba	..	213	..	279	7.0	..	3 853	..	3 986	0.9
Bahamas	828	602	-2.9	565	-1.6	3 851	2 275	-4.8	2 025	-2.9
Barbados	210	328	4.1	312	1.4	814	1 274	4.0	1 195	-1.6
Cuba	10 303	8 717	-1.5	9 023	0.2	1 046	829	-2.1	823	-0.2
Dominica	13	21	4.4	29	8.4	173	296	4.9	408	8.4
Grenada	20	40	6.3	57	7.3	183	473	8.7	620	7.0
Haiti	223	244	0.8	220	-4.2	37	39	0.5	31	-5.6

Country or area	Total energy consumption (thousands of tons of oil equivalent)					Per capita consumption (kilograms of oil equivalent)				
	1982	1992	Annual change 1982–1992 (percentage)	1995	Annual change 1992–1995 (percentage)	1982	1992	Annual change 1982–1992 (percentage)	1995	Annual change 1992–1995 (percentage)
Jamaica	1 917	2 604	2.8	2 959	3.7	861	1 065	1.9	1 199	3.0
Netherlands Antilles	2 444	923	-8.8	850	-2.1	9 660	4 874	-6.2	4 381	-2.6
Saint Kitts and Nevis	21	25	1.6	32	6.4	467	595	2.2	780	7.0
Saint Lucia	36	57	4.2	64	2.9	293	416	3.2	451	2.0
Saint Vincent and the Grenadines	15	31	6.6	44	10.0	149	275	5.6	393	9.3
United States Virgin Islands	2 812	2 266	-2.0	2 739	4.4	28 120	22 379	-2.1	26 806	4.6
Mediterranean										
Cyprus	831	1 446	5.0	1 518	1.2	1 292	2 051	4.2	2 038	-0.2
Others										
Bahrain	3 360	5 514	4.5	6 910	6.5	8 842	10 388	1.5	12 406	4.5
Singapore	10 496	16 482	4.1	20 056	5.0	4 239	5 244	1.9	6 028	3.5
Trinidad and Tobago	4 549	7 458	4.5	6 759	-2.5	4 208	5 948	3.2	5 252	-3.1

Note: Two dots (..) indicate that data are not available or are not available separately.

Source: Department of Economic and Social Affairs of the United Nations Secretariat, based on United Nations, *Energy Statistics Yearbook, 1984* (United Nations publication, Sales No. E/F.86.XVII.2) and United Nations, *Energy Statistics Yearbook, 1995* (United Nations publication, Sales No. E/F.97.XVII.8).

Table 2
Share of petroleum imports in total merchandise imports and exports, 1992 and 1995

Country or area	1992[a]						1995[a]					
	Net petroleum imports (thousands of tons of oil equivalent)	*Petroleum imports (millions of United States dollars)[b]*	*Total merchandise imports (millions of United States dollars)*	*Petroleum imports (percentage of total imports)*	*Total merchandise exports (millions of United States dollars)*	*Petroleum imports (percentage of total exports)*	*Net petroleum imports (thousands of tons of oil equivalent)*	*Petroleum imports (millions of United States dollars)[b]*	*Total merchandise imports (millions of United States dollars)*	*Petroleum imports (percentage of total imports)*	*Total merchandise exports (millions of United States dollars)*	*Petroleum imports (percentage of total exports)*
Atlantic												
Cape Verde	36	4.41	180.0	2.45	5.00	88.14	38	4.35	210.00	2.07	5.00	87.0
Sao Tome and Principe	25	3.06	..	..	..	..	26	2.98	..	..	..	..
Indian Ocean and adjacent areas												
Comoros	22	2.69	69.00	3.90	22.00	12.24	23	2.63	..	..	..	..
Maldives	85	10.41	189.00	5.51	40.00	26.01	112	12.83	268.00	4.79	50.00	25.7
Mauritius	690	84.47	1 623.00	5.20	1 290.00	6.55	785	89.91	1 959.00	4.59	1 537.00	5.9
Seychelles	161	19.71	192.00	10.27	44.00	44.80	168	19.24	233.00	8.26	53.00	36.3
Pacific												
Cook Islands	15	1.84	59.00	3.11	3.00	61.21	15	1.72	..	..	..	..
Fiji	401	49.09	624.00	7.87	435.00	11.29	404	46.27	867.00	5.34	619.00	7.5
Kiribati	7	0.86	37.00	2.32	5.00	17.14	7	0.80	34.00	2.36	7.00	11.5
Marshall Islands	..	..	..	..	..	..	..	..	..	..	..	..
Micronesia (Federated States of)	..	..	..	..	..	..	..	..	..	..	..	..
Nauru	49	6.00	..	..	..	..	50	5.73	..	..	..	..
Niue	1	0.12	..	..	..	..	1	0.11	..	..	..	..
Palau	94	11.51	..	..	..	..	95	10.88	..	..	..	..
Papua New Guinea	..	..	1 523.00	..	1 790.00	..	..	82.92	1 452.00	..	..	3.1
Samoa	45	5.51	113.00	4.88	6.00	91.82	44	5.04	95.00	5.30	9.00	56.0
Solomon Islands	53	6.49	97.00	6.69	84.00	7.72	55	6.30	142.00	4.44	168.00	3.8

Country or area	1992[a]						1993[a]					
	Net petroleum imports (thousands of tons of oil equivalent)	Petroleum imports (millions of United States dollars)[b]	Total merchandise imports (millions of United States dollars)	Petroleum imports (percentage of total imports)	Total merchandise exports (millions of United States dollars)	Petroleum imports (percentage of total exports)	Net petroleum imports (thousands of tons of oil equivalent)	Petroleum imports (millions of United States dollars)[b]	Total merchandise imports (millions of United States dollars)	Petroleum imports (percentage of total imports)	Total merchandise exports (millions of United States dollars)	Petroleum imports (percentage of total exports)
Tokelau	..	..	..	..	..	..	..	..	..	..	..	..
Tonga	33	4.04	63.00	6.41	12.00	33.67	38	4.35	77.00	5.65	15.00	29.0
Tuvalu	..	..	..	..	..	..	..	..	..	..	..	..
Vanuatu	20	2.45	83.00	2.95	20.00	12.24	20	2.29	95.00	2.41	28.00	8.2
Caribbean												
Antigua and Barbuda	96	11.75	246.00	4.78	40.00	29.38	158	18.10	..	..	..	..
Aruba	564	69.05	481.00	14.35	26.00	265.56	591	67.69	..	..	..	..
Bahamas	753	92.18	1 038.00	8.88	192.00	48.01	2 835	324.71	1 243.00	26.12	176.00	184.5
Barbados	328	40.15	521.00	7.71	190.00	21.13	308	35.28	766.00	4.61	238.00	14.8
Cuba	8 370	1 024.66	2 185.00	46.90	2 050.00	49.98	8 792	1 007.01	2 825.00	35.65	1 600.00	62.9
Dominica	21	2.57	111.00	2.32	56.00	4.59	27	3.09	96.00	3.22	45.00	6.9
Dominican Republic	3 422	418.92	2 501.00	16.75	562.00	74.54	3 617	414.28	2 976.00	13.92	765.00	54.2
Grenada	40	4.90	107.00	4.58	20.00	24.48	58	6.64	..	..	..	..
Jamaica	2 604	318.78	1 675.00	19.03	1 097.00	29.06	2 813	322.19	2 756.00	11.69	1 380.00	23.3
Netherlands Antilles	923	112.99	1 868.00	6.05	1 559.00	7.25	850	97.36	..	..	..	..
Saint Kitts and Nevis	25	3.06	96.00	3.19	26.00	11.77	32	3.67	..	..	..	..
Saint Lucia	57	6.98	313.00	2.23	123.00	5.67	64	7.33	..	..	..	..
Saint Vincent and the Grenadines	31	3.80	132.00	2.88	78.00	4.87	42	4.81	136.00	3.54	43.00	11.2
United States Virgin Islands	2 266	277.41	..	..	..	..	2 739	313.72	..	..	..	..
Mediterranean												
Cyprus	1 446	177.02	3 289.00	5.38	1 002.00	17.67	1 989	227.81	3 690.00	6.17	1 229.00	18.5

Country or area	1992[a]						1995[a]					
	Net petroleum imports (thousands of tons of oil equivalent)	Petroleum imports (millions of United States dollars)[b]	Total merchandise imports (millions of United States dollars)	Petroleum imports (percentage of total imports)	Total merchandise exports (millions of United States dollars)	Petroleum imports (percentage of total exports)	Net petroleum imports (thousands of tons of oil equivalent)	Petroleum imports (millions of United States dollars)[b]	Total merchandise imports (millions of United States dollars)	Petroleum imports (percentage of total imports)	Total merchandise exports (millions of United States dollars)	Petroleum imports (percentage of total exports)
Others												
Bahrain	..	..	4 125.00	..	3 368.00	..	..	..	3 626.00	..	4 044.00	..
Singapore	16 482	2 017.74	72 534.00	2.78	63 516.00	3.18	20 256	2 320.06	124 502.00	1.86	118 263.00	2.0
Trinidad and Tobago	..	..	1 168.00	..	1 691.00	..	..	..	1 714.00	..	2 456.00	..

Note: Two dots (..) indicate that data are not available or are not available separately.

Source: Department of Economic and Social Affairs of the United Nations Secretariat, based on United Nations, *Energy Statistics Yearbook, 1995* (United Nations publication, Sales No. E/F.97.XVII.8) and *Statistical Yearbook*, No. 42 (1997) (United Nations publication, Sales No. E/F.97.XVII.1).

[a] Petroleum prices for 1992 (US$16.77 per barrel) and 1995 (US$15.69 per barrel) were weighted average cost insurance freight (CIF) costs of imports of member countries of the International Energy Agency; CIF costs of petroleum imports of several small island developing States may be higher considering the supply distances.

[b] Estimated.